

AMENDMENT UNDER 37 C.F.R. § 1.116
Application No.: 10/049,188
Atty Docket No.: Q63028

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

Claim 1. (currently amended): A fuel cell comprising an electrolyte sandwiched by electrodes having a catalyst layer and a gas diffusion layer, or an assembly for a fuel cell comprising an electrolyte sandwiched by electrodes having a catalyst layer and a gas diffusion layer, characterized in that (i) the catalyst layer comprises a catalyst-bearing conductive powder particles and a graphitized vapor grown carbon fiber having a fiber filament diameter of 10-300 nm, and/or (ii) the gas diffusion layer comprises a layer containing a water repellent resin and a graphitized vapor grown carbon fiber having a fiber filament diameter of 10-300 nm, and wherein at least part of the surface of the gas diffusion layer is in contact with the catalyst layer.

Claim 2. (withdrawn): A catalyst composition for a cell comprising catalyst-bearing conductive powder particles and a vapor grown carbon fiber having a fiber filament diameter of 10-300 nm.

Claim 3. (withdrawn): The catalyst composition for a cell as claimed in claim 2, wherein the catalyst accelerates oxidation-reduction reaction in a fuel cell.

Claim 4. (withdrawn): The catalyst composition for a cell as claimed in claim 2 or 3, wherein the catalyst is platinum or a platinum alloy.

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Claim 5. (withdrawn): The catalyst composition for a cell as claimed in any one of claims 2 through 4, wherein the conductive powder particles are conductive carbon black or conductive carbonaceous powder particles.

Claim 6. (withdrawn): The catalyst composition for a cell as claimed in any one of claims 2 through 5, wherein the conductive powder particles are at least one species selected from the group consisting of furnace black, acetylene black, thermal black, channel black, and Ketjen Black.

Claims 7 and 8. (canceled).

Claim 9. (withdrawn): The catalyst composition for a cell as claimed in claim 2, wherein the entirety of the catalyst-bearing conductive powder particles and the vapor grown carbon fiber contains the vapor grown carbon fiber in an amount of 0.1-30 mass%.

Claim 10. (withdrawn): The catalyst composition for a cell as claimed in claim 2 or 9, wherein the vapor grown carbon fiber has been heat-treated at a temperature of at least 2,300°C.

Claim 11. (withdrawn): The catalyst composition for a cell as claimed in any one of claims 2 or 10, wherein the vapor grown carbon fiber contains boron in an amount of 0.01-10 mass%.

Claim 12. (withdrawn): The catalyst composition for a cell as claimed in claim 2, wherein the vapor grown carbon fiber having a fiber filament diameter of 10-300 nm has a filament length of 100 µm or less.

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Claim 13. (canceled).

Claim 14. (withdrawn): An electrode material comprising a conductive substrate and a catalyst layer formed thereon, the catalyst layer containing a catalyst composition for a cell as recited in any one of claims 2 through 13.

Claim 15. (withdrawn): The electrode material as claimed in claim 14, wherein the conductive substrate is a porous conductive substrate.

Claim 16. (withdrawn): A polymer electrolyte fuel cell comprising a polymer electrolyte membrane and a pair of electrodes which sandwich the electrolyte membrane, each electrode including a catalyst layer, characterized in that the catalyst layer includes a conductive substrate and a catalyst layer containing catalyst-bearing conductive powder particles and fibrous carbon.

Claim 17. (currently amended): A membrane-electrode assembly for a fuel cell comprising an electrolyte membrane having first and second surfaces, a first electrode on the first surface and a second electrode on the second surface, wherein each and an electrode including includes a catalyst layer and a gas diffusion layer, the electrode being provided on each surface of the electrolyte membrane, wherein at least a portion of the surface of the gas diffusion layer which is in contact with the catalyst layer includes a layer containing a hydrophobic resin and a graphitized vapor grown carbon fiber having a fiber filament diameter of 10 to 300 nm.

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Claim 18. (original): The membrane-electrode assembly for a fuel cell as claimed in claim 17, wherein at least a portion of the surface of the gas diffusion layer which is in contact with the catalyst layer further includes conductive powder particles.

Claim 19. (original): The membrane-electrode assembly for a fuel cell as claimed in claim 17 or 18, wherein at least a portion of the surface of the gas diffusion layer which is in contact with the catalyst layer further includes spaces.

Claim 20. (original): The membrane-electrode assembly for a fuel cell as claimed in claim 19, wherein, in a cross section of the gas diffusion layer, the cross section area of spaces having a size of 0.1-50 μm accounts for at least 40% of the total cross section area of all the spaces.

Claim 21. (currently amended): A membrane-electrode assembly for a fuel cell comprising an electrode membrane ~~and an~~ having first and second surfaces, a first electrode on the first surface and a second electrode on the second surface, wherein each electrode including includes a catalyst layer and a gas diffusion layer, ~~the electrode being provided on each surface of the electrolyte membrane,~~ wherein at least a portion of the surface of the gas diffusion layer which is in contact with the catalyst layer includes a layer containing a hydrophobic resin and a graphitized vapor grown carbon fiber having a fiber filament diameter of 10-300 nm, wherein at least a portion of the surface of the gas diffusion layer which is in contact with the

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catalyst layer further includes conductive powder particles and the conductive powder particles are conductive carbon black or conductive carbon powder particles.

Claim 22. (currently amended): A membrane-electrode assembly for a fuel cell comprising an electrolyte membrane having first and second surfaces, a first electrode on the first surface and a second electrode on the second surface, wherein each and an electrode including includes a catalyst layer and a gas diffusion layer, ~~the electrode being provided on each surface of the electrolyte membrane,~~ wherein at least a portion of the surface of the gas diffusion layer which is in contact with the catalyst layer includes a layer containing a hydrophobic resin and a graphitized vapor grown carbon fiber having a fiber filament diameter of 10 - 300 nm, and wherein the layer comprising the hydrophobic resin and the vapor grown carbon fiber contains the vapor grown carbon fiber in an amount of 1-95 mass%.

Claim 23. (original): The membrane-electrode assembly for a fuel cell as claimed in claim 22, wherein the vapor grown carbon fiber has been formed through heat treatment at a temperature of at least 2,000°C.

Claim 24. (original): The membrane-electrode assembly for a fuel cell as claimed in claim 22 or 23, wherein the vapor grown carbon fiber contains boron in an amount of 0.01-10 mass%.

Claim 25. (canceled).

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Claim 26. (currently amended): The membrane-electrode assembly for a fuel cell as claimed in claim 22, wherein the vapor grown carbon fiber has a fiber filament length of 100 μm or less.

Claim 27. (currently amended): The membrane-electrode assembly for a fuel cell as claimed in claim 17, wherein the hydrophobic resin is a fluorine-based resin.

Claim 28. (withdrawn): A process for producing a layer assembly for a fuel cell, comprising a step for forming a gas diffusion layer by applying a conductive porous substrate onto or immersing the conductive porous substrate in a composition comprising conductive powder particles, a hydrophobic resin, and a vapor grown carbon fiber having a fiber filament diameter of 10-300 nm; a step for forming an electrode by forming a catalyst layer comprising catalyst-bearing carbon particles on the surface of the gas diffusion layer, the composition being applied onto the surface of the gas diffusion layer or the gas diffusion layer being immersed in the composition; and a step for bonding the catalyst layer of the electrode to each surface of an electrolyte membrane.

Claim 29. (currently amended): A fuel cell comprising a membrane-electrode assembly for a fuel cell comprising an electrolyte membrane having first and second surfaces, a first electrode on the first surface and a second electrode on the second surface, wherein each and an-electrode including includes a catalyst layer and a gas diffusion layer, the electrode being provided on each surface of the electrolyte membrane, wherein at least a portion of the surface of the gas diffusion layer which is in contact with the catalyst layer includes a layer containing a

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hydrophobic resin and a graphitized vapor grown carbon fiber having a fiber filament diameter of 10 - 300 nm and separators which sandwich the membrane-electrode assembly.

Claim 30. (currently amended): A fuel battery comprising at least two fuel cells as recited in claim 29, which are layered together.